Ground Water, Surface Water, and Leachate

Directional Wells

Introduction:

Drilling techniques are utilised to place wells horizontally, or at an angle, in order to reach contaminants not within reach by direct vertical drilling.

Description:

Directional drilling can be used to stimulate other *in-situ* or in-well technologies such as ground water pumping, bioventing, SVE, soil flushing, and in-well air stripping.

Equipment needed for directional boring comprise of wire line coring rigs, hydraulic thrust systems, electric cone penetrometers, steering tracking hardware, sonic drilling, and push coring systems. Hydraulically activated thrust equipment competent of exerting more than 40 tons of thrust is utilised to drive the directional boring heads into the ground. Proper positioning of the face of the non-symmetric boring head manages directional control. Slow rotation of the boring head will cut and condense the geologic material into the borehole wall. Thrusting a boring head that is not rotating may cause a directional change. The machinery is able to initiate a borehole, steer down to a required horizontal depth, continue drilling at that depth for the desired time, and then steered back to the surface at a downrange position.

Applicability:

Directional well technology is appropriate for a range of contaminant groups with no specific target group. It is predominantly valuable when existing structures hinder the placement of the vertical wells.

Limitations:

- Potential exists for the wells to collapse.
- Expert equipment is required.
- Wells are challenging to position accurately.
- Putting in horizontal wells is typically costly.
- At present, the technology is restricted to depths of less than 50 feet.

Data Needs:

Standard data are required.

Performance Data:

Field experiments at Savannah River sites was performed for *in situ* air stripping (ISAS), a mass transfer process that exploits horizontal injection and vacuum extraction wells to remediate sites contaminated with VOCs within the vadose zone and soil/ground water in the saturated zone. Air is injected into the saturated zone by means of horizontal injection wells placed below the water table. As the air passes through the contaminant plume, it volatilises the chemical constituents. This process performs greatest in homogeneous soil conditions, while heterogeneities including formations, fractures, clay layers, and partial clay lenses can hamper performance. Clay layers frequently have high contaminant concentrations, while stratigraphy can cause preferential flow paths and limit the process effectiveness. ISAS has been shown to be valuable when some interbedded, thin, and/or discontinuous clays exist. Better underground transport modelling and bioremediation modelling are required.

Cost:

Approximate costs are in the region of £ 35 to £ 180 per meter for hydraulic bi-directional thrust drilling. Sonic drilling can be as much as £ 200 per meter, though the market offers competition.